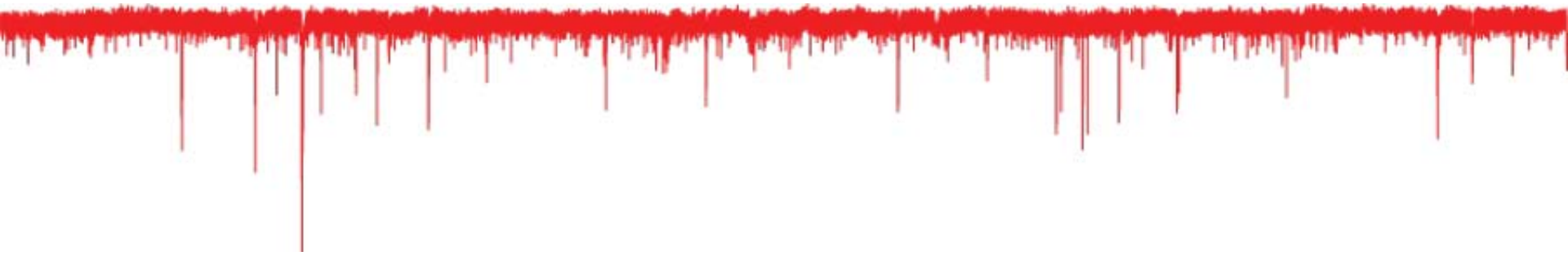
Separating *spikes* and *secretions*

Jon Newman and Ming-fai Fong

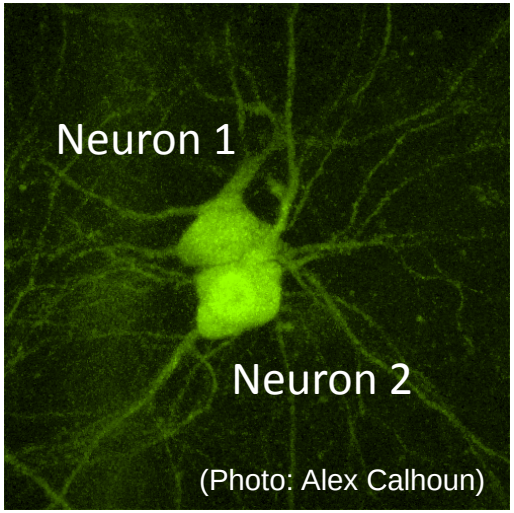
Potter Lab

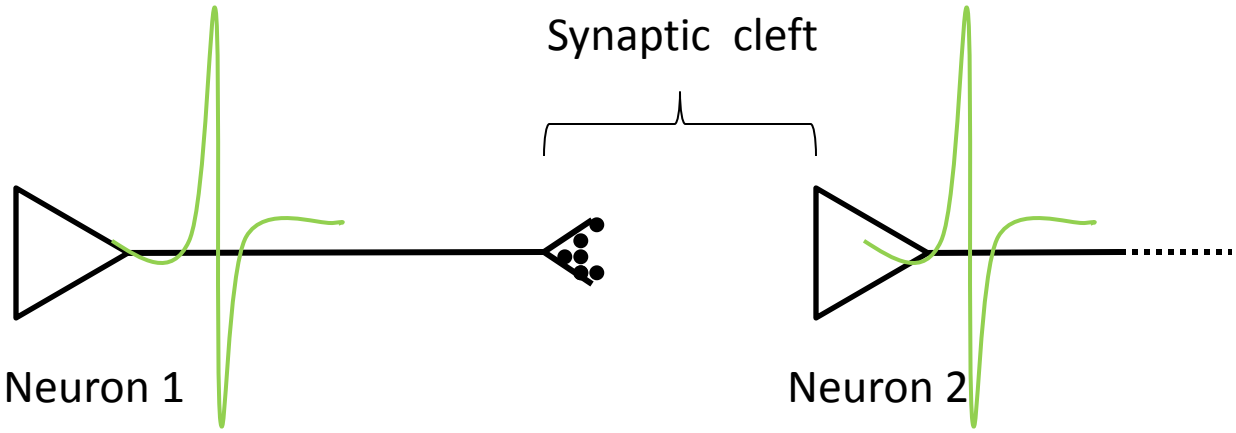
Georgia Tech



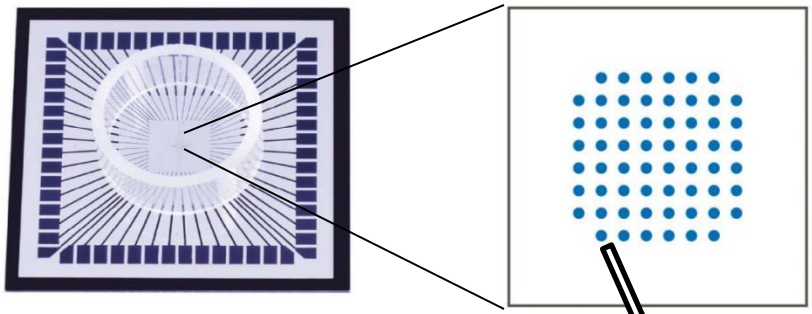
Spikes and secretions

- Your thoughts are made of:
  (1) Spikes (Action potentials)
  (2) Secretions (Neurotransmission)

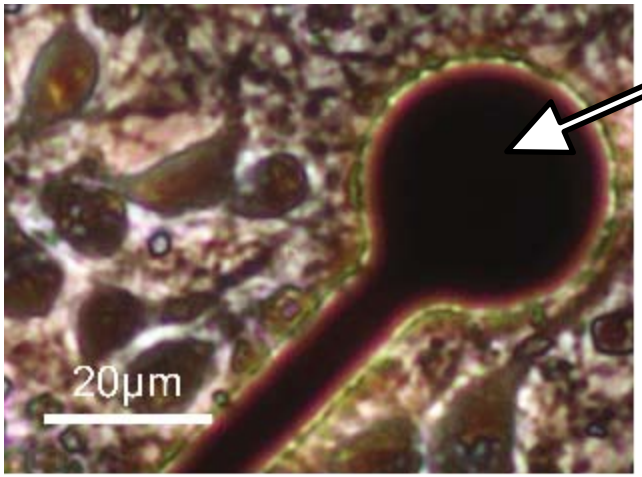


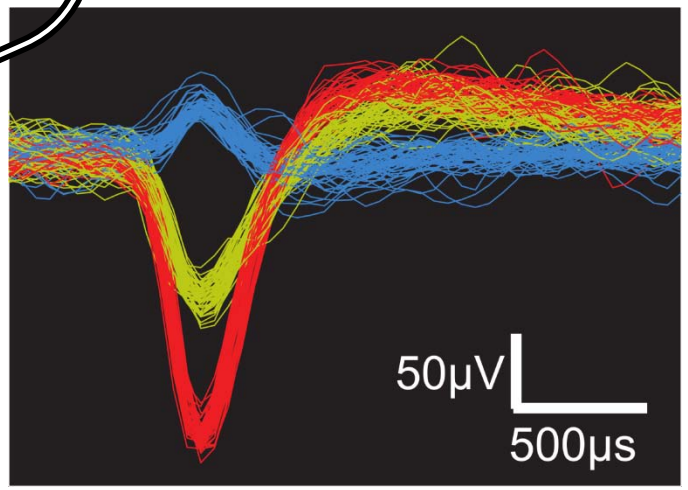


Monitoring spikes

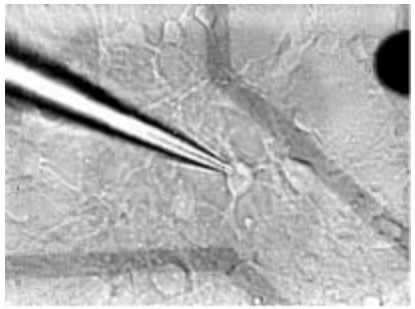


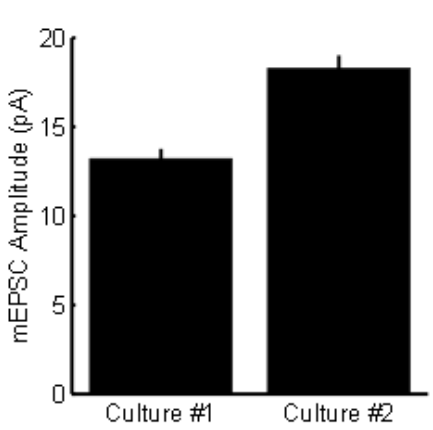
Micro-electrode array

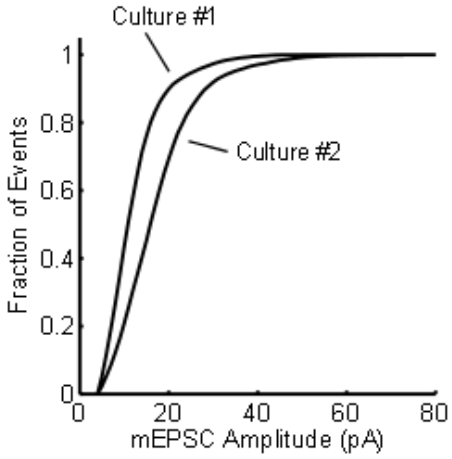


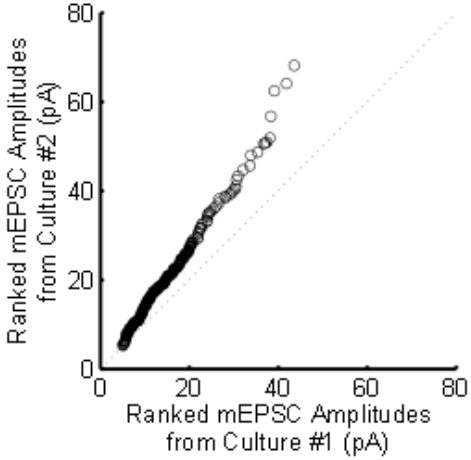


Monitoring secretions







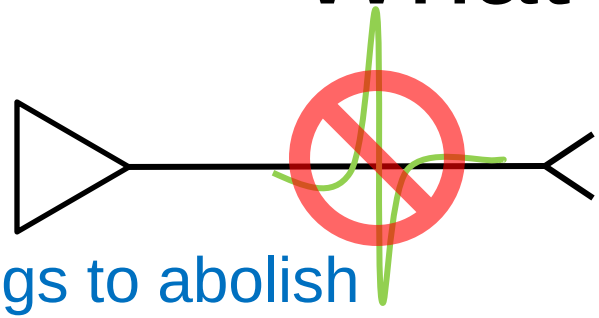


Homeostasis

- If we decrease **‘neural activity’** using drugs, then brain tissue becomes more excitable
  - Synapses get *stronger*
- If we increase **‘neural activity’** using drugs, then brain tissue becomes less excitable
  - Synapses get *weaker*

What is **neural activity?**

What is activity?



Drugs to abolish Spiking (TTX)

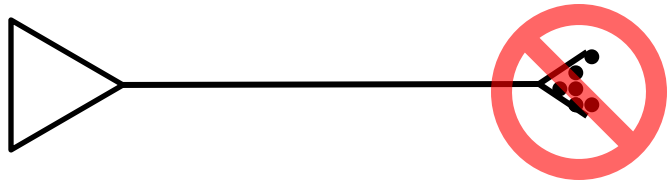
Reduce spiking

Experimental confound…

Secretions get stronger

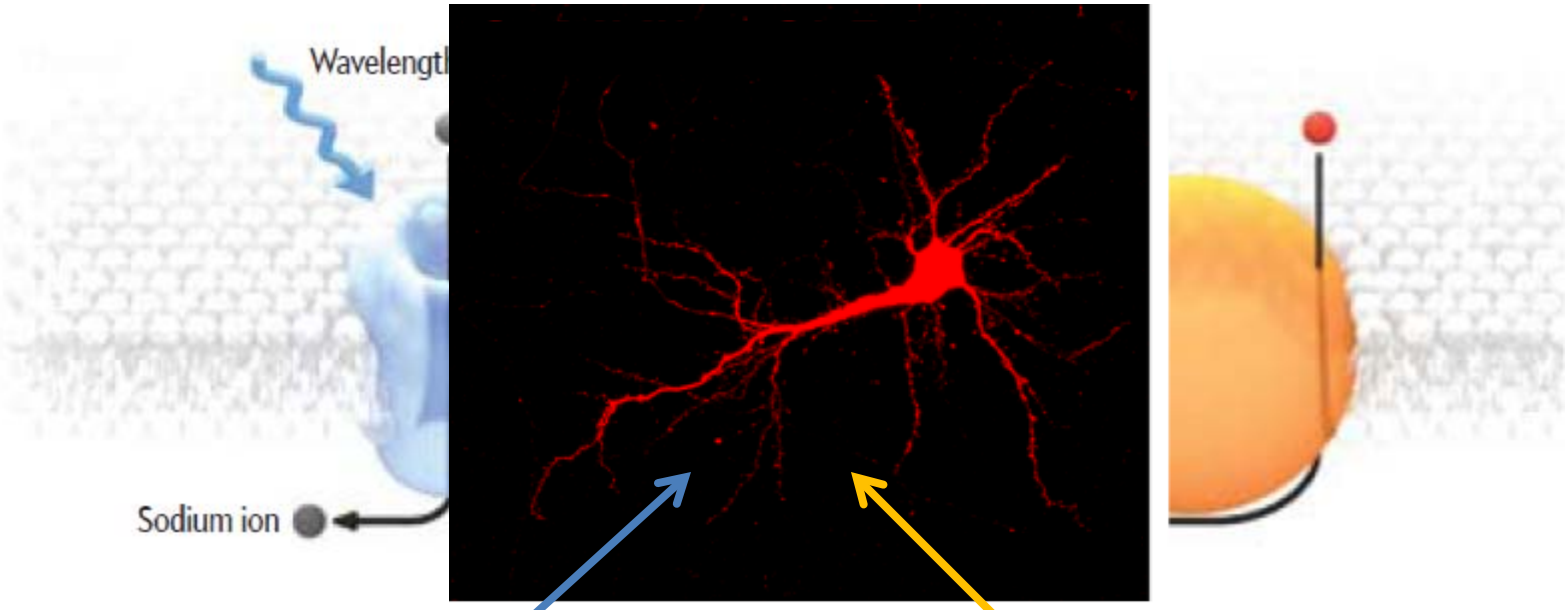
Drugs to abolish Secretions (CNQX)

Reduce secretions



Separating spikes and secretions

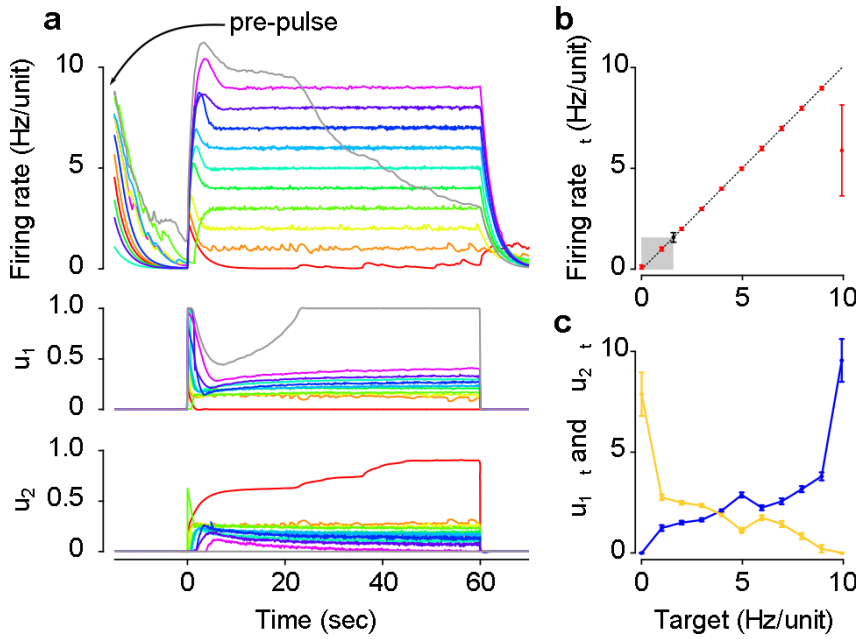
- **Optogenetics** – allows genetically targeted control of *<u>spiking activity</u>*

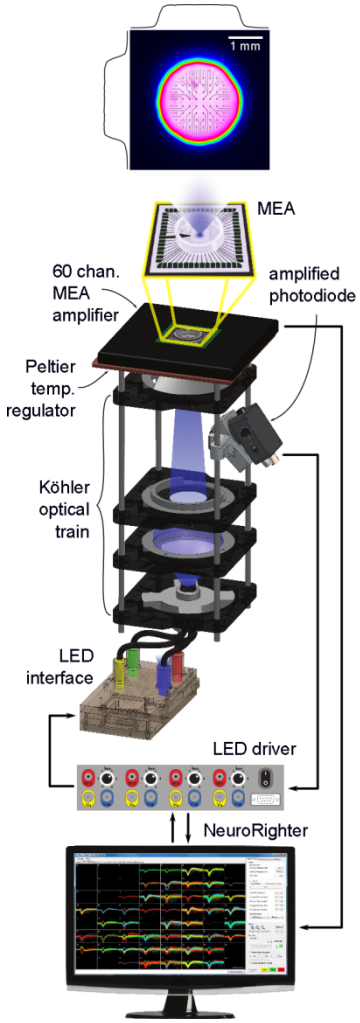


(figure adapted from: K. Deisseroth, *Scientific American*, Nov 2010, pp. 48-55)

Separating spikes and secretions

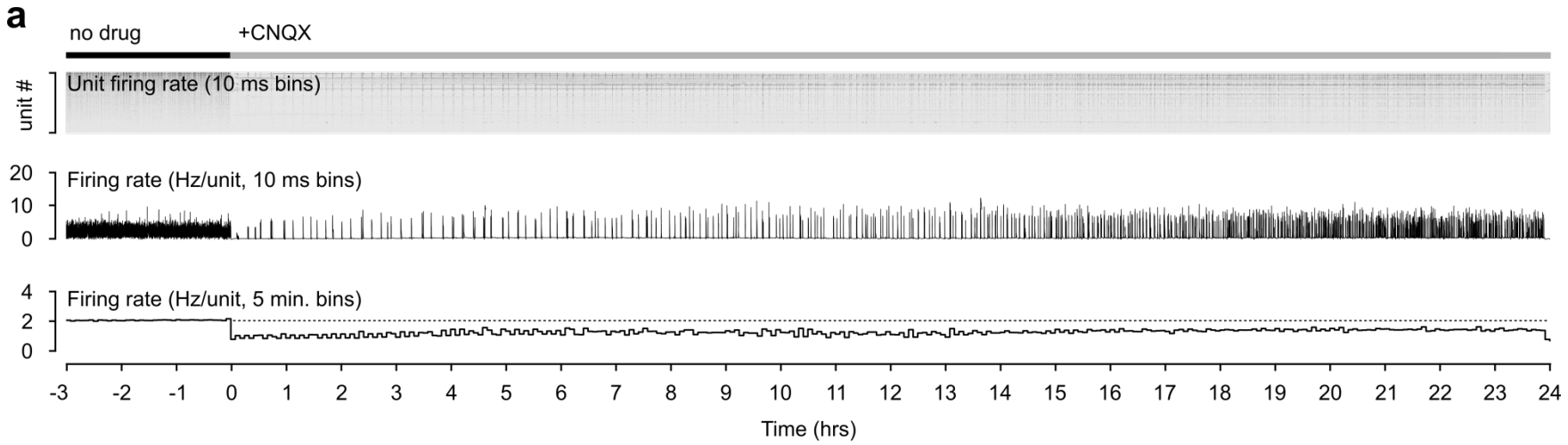
- **Real-time feedback -** used to clamp spiking





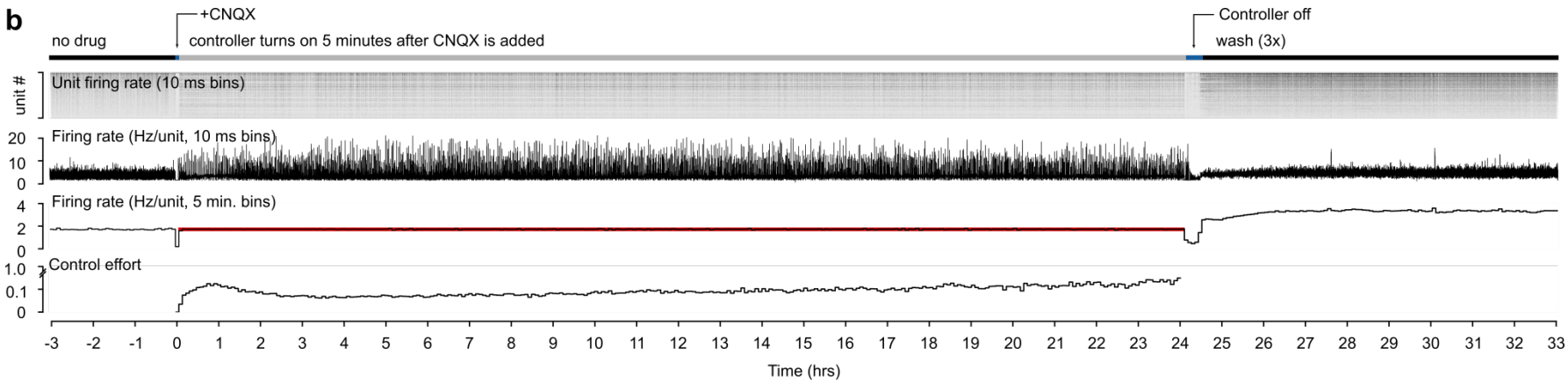
Separating spikes and secretions

The effects of blocking neurotransmission on spiking



Separating spikes and secretions

Decoupling neurotransmission and spiking



So, what is activity?

- Strong preliminary evidence that:

activity = secretions

- Impact
  - Drug development for epilepsy
  - Understanding cortical development and disorders

Collaborators

Dr. Steve M. Potter
(Georgia Tech)

Dr. Pete Wenner
(Emory University)

Riley Zeller-Townson
(Georgia Tech)

Ming-fai Fong
(Emory University)

Ted French
(Now at Michigan)

Alex Calhoun
(Georgia Tech)